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# RADIUM

EDITED BY  
CHARLES H. VIOL, Ph. D.  
AND  
WILLIAM H. CAMERON, M. D.

VOL. XI

MAY, 1918

No. 2

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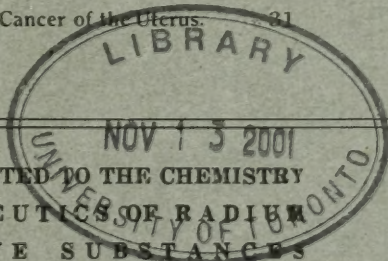
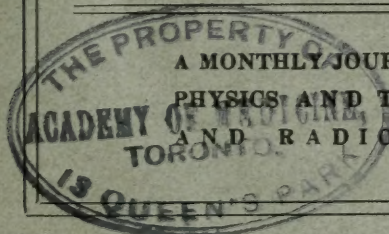
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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY  
PHYSICS AND THERAPEUTICS OF RADIUM  
AND RADIO-ACTIVE SUBSTANCES







# RADIUM

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Edited and Published by Charles H. Viol, Ph. D., and William H. Cameron, M. D.  
with the assistance of collaborators working in the fields of  
Radiochemistry, Radioactivity and Radiumtherapy.

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## A REPORT OF THE WORK OF THE MANCHESTER AND DISTRICT RADIUM INSTITUTE

FROM JANUARY 1ST, 1917, TO DECEMBER 31ST, 1917.

BY ARTHUR BURROWS, M.D., *Radiologist*.  
MANCHESTER, ENG.

Between January 1, 1917, and December 31, 1917, 588 cases have presented themselves at the Manchester and District Radium Institute with a view to radium treatment. This shows an increase of eighty-six patients over the year 1916, when 502 were seen.

In a certain number of the patients suffering from malignant disease the condition was too far advanced even to administer radium, but the same rule as heretofore was applied, namely, that those patients only were treated who were suffering from carcinoma or sarcoma, that had been deemed inoperable by the surgeons.

The practice of writing to patients regularly to ask them to attend for re-examination was adhered to, but possibly owing to the present unsettled conditions and the preoccupation of individuals, it has been found more difficult to persuade patients to return.

Mr. Lupton, the physicist, reports that 393 emanation plates, 896 emanation tubes, and ninety-eight emanation needles, making a total of 1,388, were made during the year. This shows a decrease of forty-three in the total number of plates and tubes made in the year 1917 as against 1916, but as the average strength of the tubes was much greater than that of those made in the previous year, actually a considerably larger quantity of radium emanation has been used. Practically the whole of the emanation is now employed daily for medical work, so that it is not possible to increase the output.

Mr. Lupton is still engaged in part-time work at the university, but when the new research laboratory is completed, the construction of



which has now commenced, it will be necessary to utilize more of his services for the research work which will be conducted there.

Thirty-six cases of malignant disease, exclusive of rodent ulcer, were rendered free from symptoms and signs during the course of the year. This represents just over nine per cent. of the cancerous cases treated. The total of thirty-six cases comprises: six of carcinoma of the breast, eight of carcinoma of the cervix of the uterus, one of carcinoma of the thyroid gland, one of carcinoma of the vulva, one of carcinoma of the parotid gland, one of carcinoma of the bladder, five of carcinoma of the mouth and tongue, six of carcinoma of the skin, two of carcinoma of the body of the uterus, one of carcinoma of the lip, three of sarcoma, one of endothelioma.

The best results were obtained in cases of carcinoma of the cervix of the uterus. This disease is dealt with in more detail later in the report.

In carcinoma of the mouth and tongue, the results have been the most satisfactory when the lesion has been inoperable from its position rather than from its extent. Whenever the lesion is removed in a satisfactory manner the treatment has always been carried out by the implantation of radium emanation tubes.

Carcinoma of the skin is the most accessible malignant growth, and to this fact is largely due the high proportion of cases which are satisfactory from the point of view of radium treatment. The same observation to a certain extent holds good when dealing with carcinoma of the breast, but these cases are often rendered more difficult by the size and extensive infiltration of the growth, together with the more rapid formation of the metastases.

Twenty-four cases of rodent ulcer and thirteen non-malignant conditions were apparently cured in addition to the above mentioned cases of malignant disease.

Two classes of disease have been treated extensively by radium in which it is difficult to say that a complete cure may be effected, although the results obtained often approximate to a cure. These are: (1) Exophthalmic goitre, which is dealt with in more detail later; (2) keloids and vicious scars. In this last condition practically every case that was persevered with improved, and the keloidal nature of the growth lost, but some scar tissue must always remain.

In addition to the seventy-three cases which are reported upon as being free from disease on December 31, 1917, fourteen cases of malignant disease, four of rodent ulcer and nine of other conditions, which in the year 1916 report were classed as "improved" or "too early for observation to be made," were rendered free from symptoms and signs during 1917.

Thus 100 completely satisfactory cases have been observed during the period covered by this report.

**CARCINOMA OF THE CERVIX OF THE UTERUS.** During the past three years 139 cases suffering from this disease were treated. Concerning twenty-five of these no information has been received as to the result of the application of the radium. Seven cases were too recently treated for any result to be noted. This leaves 107 cases upon which to report.

The usual treatment adopted in carcinoma of the cervix of the uterus is as follows: One central tube of radium emanation of a strength of thirty to fifty millicuries, contained in a silver tube, the wall of

which is one millimetre thick, is introduced into the cervical canal, and from two to six platinum tubes, the walls of which are three-tenths millimeters thick, containing from twelve to twenty-five millicuries of radium emanation are buried in the peripheral part of the tumour. The vagina is then packed with gauze, to help to maintain the tubes securely in position. The radium is then left in the growth for twenty-four hours. The platinum tubes are occasionally replaced by Stevenson's and Jolly's needles. It has been found that on the whole the best results are obtained when large quantities of radium are employed, though the dose must depend somewhat upon the size of the tumour. It is probable that larger doses of radium heavily screened are more effective than smaller doses more lightly screened. Seven cases that were referred to the institute by gynæcological surgeons, owing to the advanced nature of the growth, improved so much by the use of radium that operation was undertaken later on for the removal of the uterus. In one of these it was found that the fibrosis surrounding the cervix rendered its removal impossible. Another patient died from a complication, and the other five are alive and well. In two instances a microscopic examination was made of the uterus after removal, and no trace could be found of the original cancer.

Fifteen patients previously suffering from carcinoma of the cervix of the uterus were well at the end of 1917. Two have been well over two years, three have been well over one year, five have been well under one year, and five are well as a result of the combined use of radium and operation.

Ninety-two cases remain for consideration.

Six cases are recorded as having died.

Fourteen cases were too far advanced for treatment to be advised.

Nine cases received no benefit from the application of radium.

Sixty-three have enjoyed periods of practical immunity from symptoms and signs, other than the palpable presence of the tumour. Of these:

One case has been free from symptoms for over two years.

Five cases have been free from symptoms for over one year.

Twenty-six cases have been free from symptoms for six months or more.

Thirty-two have been free from symptoms for less than six months, but some of them are too recent for an estimate to be formed of the total duration of their immunity from symptoms.

The cases which have responded best to radium treatment are those which are just beyond the stage of being operable. The least benefit is to be expected from those in which there is extensive infiltration of the vagina, or a very large mass in the pelvis. When the growth is adherent to the bladder, treatment is often very difficult; but, contrary to expectations, some most advanced cases will respond remarkably well to radium treatment.

The youngest patient treated for carcinoma of the cervix of the uterus was twenty-six years of age, the oldest was aged eighty-four years. Four were under thirty years of age, fifteen were between thirty and forty years of age, fifty were between forty and fifty years of age, forty-four were between fifty and sixty years of age, fourteen were between sixty and seventy years of age, three were over seventy years of age, and



# RADIUM

## CLASSIFIED RESULTS.

### TABLE I.

Well at end of year .....	73
Improved .....	208
Not improved .....	74
Died of the disease .....	22
Not suitable for treatment .....	70
Too early and no information received .....	128
Prophylaxis .....	13
<b>Total .....</b>	<b>588</b>

The number of cases registered during the year was 588.

### TABLE II.

#### Classification of Cases.

DISEASE	Too early and no information received as to result.	Well at end of year.	Improved.	Not improved.	Died of their disease.	Not suitable.	Prophylaxis.	Total.
<b>Carcinomata:</b>								
Anus .....	1	—	—	1	—	—	—	2
Body of uterus .....	—	2	—	1	—	—	—	3
Bladder .....	—	1	2	—	1	1	1	6
Breast .....	14	6	22	8	5	15	2	72
Cervix of uterus .....	21	8	19	3	2	7	1	61
Colon .....	1	—	—	—	1	—	—	2
Larynx .....	2	—	—	1	—	—	—	3
Lip .....	2	1	1	1	—	—	1	6
Mouth and Tongue ....	17	5	24	16	1	17	1	81
Ovary .....	1	—	—	3	1	3	—	8
Parotid gland .....	—	41	—	—	1	1	—	63
Rectum .....	4	—	6	9	2	3	1	25
Skin .....	2	6	10	3	1	1	1	23
Thyroid gland .....	2	1	1	—	—	1	—	6
Various .....	6	—	7	2	1	7	—	23
Vulva .....	5	1	4	2	—	1	1	14
<b>Sarcomata</b> .....	<b>6</b>	<b>3</b>	<b>13</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>33</b>
Endotheliomata .....	1	1	1	—	—	—	1	4
Rodent ulcer .....	7	24	19	2	—	—	1	53
Benign tumours .....	6	7	4	—	—	—	—	17
Keloid & vicious cicatrix....	3	—	12	2	—	—	—	17
Exophthalmic goitre .....	10	—	28	6	1	1	—	46
Nævi .....	4	—	14	3	—	—	—	21
Hodgkins' disease .....	—	—	7	2	2	—	—	11
Chronic inflammation (Tub. gland)	9	1	3	—	—	7	—	20
Spring catarrh .....	—	—	3	—	—	—	—	3
Skin diseases .....	3	1	6	4	—	1	—	15
Uterine hæmorrhage .....	1	4	—	—	—	—	—	5
Various .....	—	—	2	3	—	—	—	5
<b>Total .....</b>	<b>128</b>	<b>73</b>	<b>208</b>	<b>74</b>	<b>22</b>	<b>70</b>	<b>13</b>	<b>588</b>

in five cases the age has not been ascertained. With the exception that when the patient is under thirty years of age the progress of the growth was much more rapid, and therefore more difficult to check, the age of the patient seems to have had little or no influence on the prognosis of the cases of carcinoma of the cervix of the uterus treated by radium.

Three cases of carcinoma of the body of the uterus were treated by radium during the year. Two are quite well at the present time and one derived no benefit from one application.

**EXOPHTHALMIC GOITRE.** Seventy-nine cases of exophthalmic goitre have been treated by the Manchester and District Radium Institute; three in 1915, thirty-three in 1916, and forty-three in 1917. All except two cases were irradiated by applying plates of a strength of 2.5 milligrammes or millicuries to the square centimetre to the surface of the enlarged gland. The size of the plates used is such that 45 to 76.5 milligrammes were applied at one time, screened by 1.5 millimetres of lead, and fixed in position for twenty-four hours. The applications were made every six weeks. At first a few cases were given exposures of less than twenty-four hours, but at shorter intervals. No additional benefit resulted from this method of application, moreover there was a greater tendency to the formation of telangiectases in the skin.

Of the above-mentioned seventy-nine cases, five were too recently treated to be reported upon, and concerning sixteen others no information was received relating to the benefit of the treatment. One patient suffering from acetonuria and jaundice died.

In ten of the remaining fifty-seven cases, the symptoms and signs are now so slight that the treatment has been suspended. Thus, palpitation has gone, general health is good, the thyroid gland is reduced to practically normal size, and the pulse is only eighty or less. These patients underwent from three to eleven treatments, an average of about eight per patient, or in other words, the application was made every six weeks for the period of one year.

Of the forty-seven remaining cases, nine have received no benefit so far, eight show a reduction of only two to eight beats per minute in the pulse, with a slight diminution in the size of the thyroid gland, and some improvement in the general health.

In the remaining thirty the pulse rate has decreased from ten to fifty beats per minute, the average reductions being twenty-one beats per minute. In all of the thirty cases the general health has improved, and the palpitation diminished. In twenty of them the thyroid gland has visibly diminished in size, and in seven the exophthalmos is much diminished. In some instances the exophthalmos was never a prominent feature.

Unfortunately it was not possible to take the weight of every patient regularly, but in the twelve cases in which it was taken the weight increased from two to fourteen pounds during the course of the treatment.

Practically all the cases were treated as out-patients, and some have been doing a considerable amount of work all the while.

An idea can usually be formed after three or four treatments of radium, as to the benefit which is likely to be received from the treatment.



Two cases were treated by the implantation of tubes in the gland, but the number is too few to offer any opinion as to the value of the treatment, because a number of cases would have to be treated in this manner before a proper system of dosage could be established. Both cases so treated were severe ones. One did not return for re-examination, but in the other considerable diminution in the size of the gland and improvement in the symptoms was noticed.

Those cases of exophthalmic goitre in which symptoms of Graves' disease supervene on an old simple enlargement of the gland are most resistant to radium treatment.

During the past 12 months Dr. Powell White, of the Cancer Research Laboratory of the University, has prepared and reported upon ten specimens of the various growths and morbid tissues submitted to him for microscopic examination. A large number of other growths have been examined at the clinical laboratories of the various hospitals participating in the scheme.

Twenty-nine military patients were treated for various diseases during the past year.

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## DISTANCE AS A FACTOR IN THE LOCAL APPLICATION OF RADIUM\*

BY CHARLES H. VIOL, PH. D., PITTSBURGH, PA.

In the development of the technic of the local application of radium, a great deal of attention has most properly been accorded to the subject of screening the radium. Screening the radium with metallic and non-metallic materials serves the general purpose of absorbing undesirable types of radiations before they can be absorbed in the tissues.

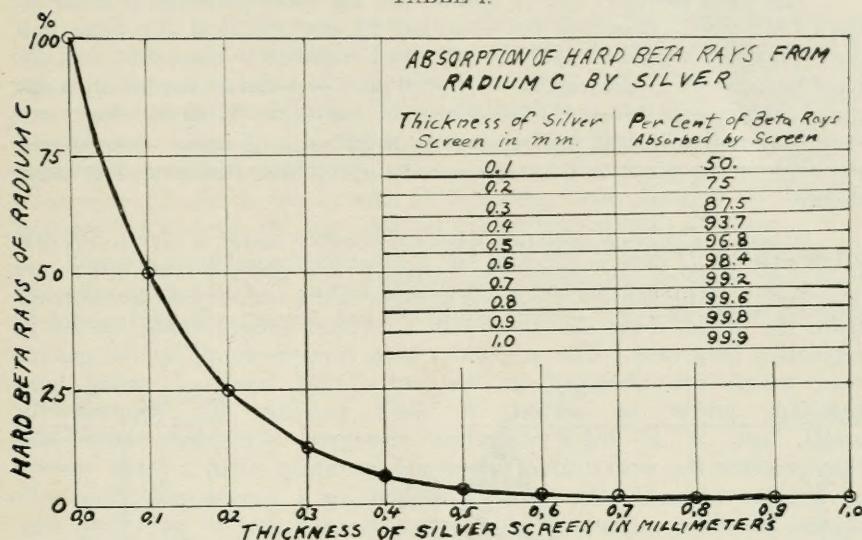
The alpha rays rarely come into play in the local application of radium, since they are so easily absorbed, a single thickness of ordinary paper sufficing for their complete removal. The beta rays are quite complex and exhibit a wide range of penetration dependent upon the velocity with which the particular electron is emitted from the transmuting radio-element.

The consideration of the absorption of a particular type of beta rays with increasing thickness of metal will suffice to exemplify in a general way the absorption of the beta and also the gamma rays. It has been found, for example, that about 0.1 mm. of silver suffices to absorb fifty per cent of the hard (most penetrating) beta rays emitted from a radium tube, these particular rays being due to a transmutation of the product Radium C. The use of 0.2 mm. of silver, however, does not effect a complete absorption of these hard beta rays, the additional 0.1 mm. of metal merely serving to absorb fifty per cent of the rays that passed through the first 0.1 mm. of metal. In the following table the first column gives the thickness of the silver screen in millimeters and the second column shows the per cent of the hard beta rays absorbed in the corresponding thickness of silver:

\* Read at the Second Annual Session of the American Radium Society, New York, June 4, 1917. Reprinted from the Radium Quarterly, No. 2, p. 10, 1917.



TABLE I.



A study of this Figure I shows, for example, that 0.5 mm. of silver suffices to absorb nearly ninety-seven per cent of the hard beta rays, and if the thickness of the screen be doubled, the additional metal is used merely to absorb the remaining three per cent of the rays.

A general rule, which holds with sufficient accuracy for all purposes, is that the absorbing power of metals for a given type of beta or gamma radiation increases in proportion to the density of the metals. Thus aluminium with a density of 2.7 as compared with water, which is about one-fourth as dense as silver (10.6), will, in accordance with the rule given above, need to be used in four times the thickness of silver to absorb a given type of rays to the same extent. In Table II are given the density, half-absorption thickness, and the thickness of various materials required to absorb ninety-nine per cent of the hard beta rays from Radium C:

DENSITY AND SCREENING POWER OF VARIOUS MATERIALS.			
Ray Absorbing Material.	Approximate Density.	Thickness of absorbing material required to absorb 50 per cent of the hard beta rays of radium.	Thickness of absorbing material required to absorb 99 per cent of the hard beta rays of radium.
Water .....	1.0	1.00 mm.	8.50 mm.
Gum rubber .....	1.0	1.00 mm.	8.50 mm.
Soft tissues .....	1.0	1.00 mm.	8.50 mm.
Bone .....	1.7-2.0	0.60 mm.	5.00 mm.
Glass (common) .....	2.6	0.40 mm.	3.30 mm.
Aluminum .....	2.7	0.40 mm.	3.20 mm.
Steel .....	7.7	0.14 mm.	1.15 mm.
Brass .....	8.5	0.13 mm.	1.10 mm.
Nickel .....	8.7	0.13 mm.	1.10 mm.
Copper .....	8.9	0.13 mm.	1.05 mm.
Silver .....	10.6	0.10 mm.	0.80 mm.
Lead .....	11.3	0.10 mm.	0.80 mm.
Gold .....	19.3	0.06 mm.	0.50 mm.
Platinum .....	21.5	0.05 mm.	0.40 mm.

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The hard gamma rays of radium are far more penetrating than the hard beta rays, requiring, for example, 13 mm. of lead for their half absorption as compared with 0.1 mm. lead required to absorb half of the hard beta rays. Consequently, to absorb 99.9 per cent of the hard gamma rays, requires ten times this thickness of lead (cf. Table I, where it is seen that ten times the half-absorbing thickness of metal absorbs 99.9 per cent of the rays) or thirteen centimeters of lead (five and one-eighth inches).

Where the gamma radiation passes through a metal, a certain proportion is absorbed in the metal, the energy of the gamma rays, which are now known to be similar in nature to light, being transferred to electrons from the metal, these electrons with increased energy being known as secondary beta rays. The secondary beta rays produced by the gamma rays which are absorbed in the outer thin layer of metal have sufficient power to permit of their passing out through the metal, and it is these so-called emergent secondary beta rays that produce the undesirable superficial irritation when a large amount of radium screened with metal is applied for a considerable time. To screen off these secondary beta rays it is necessary to use some non-metallic substance, which cannot, in turn, become the source of so great a proportion of secondary beta rays. For this purpose paper, rubber, gauze and other non-metallic materials are usually used. The penetrating power of the secondary beta rays approximates that of the primary beta rays, and a reference to Table II shows that for gum rubber 1 mm. will absorb fifty per cent of the hard beta rays. Since the concentration of the secondary beta rays is of the order of one-three hundredth of the concentration of the primary beta rays, it is evident that even 1 mm. thickness of rubber would permit the passage of but a small concentration of secondary beta rays. The usual practice is to use from one to three mm. of non-metallic screening to absorb the secondary beta rays.

A factor in the technic of radium application which is often entirely overlooked, and which is of no less importance than the screening, is that of distance. The roentgenologist has come to appreciate this distance factor as one of immense importance in his work, and the distance between the rayed tissue surface and the tube is carefully regulated. When using radium, it might seem to one giving the matter only casual thought that the tiny differences in distance between the radium and the tissues, amounting usually to a few millimeters, would not be very significant. It is because the radium tubes are in general so tiny that these small differences in distance are really very significant. Considering the rays as coming from a point source, the falling off in intensity of the radiations with distance takes place in accordance with what is known as the law of inverse squares. This is best illustrated by the diagram given below (Fig. II).

The radium is assumed to occupy a point at the top of the square pyramid. This pyramid outlines the path of a beam of rays from the radium, the dimensions of the pyramid being so chosen that the beam of rays passes through a square of one sq. mm. area, at a distance of one mm. from the radium. This being the case, it follows that all of the rays which at one mm. distance pass through one sq. mm., area pass through an area of four sq. mm. at a distance of



two mm. from the ray source. This is shown in the diagram, where corresponding to a distance of two mm., the area of the plane is given as four sq. mm., and the dose of rays per sq. mm. is consequently equal to the total dose divided by the number of sq. mm. over which it is spread, viz.: one-fourth equals 0.25. It is assumed that there is no absorption of the rays. The area of the square corresponding to a given distance from the ray source, is equal to the square of the distance, and the concentration of rays is the inverse of this area, hence the law of "inverse squares" to express the variation of concentration with distance.

One point of importance which the diagram in Fig. II makes clear is the advantage which is gained by having a radium preparation at a little distance from the tissues that are being rayed—i. e.—so-called distance

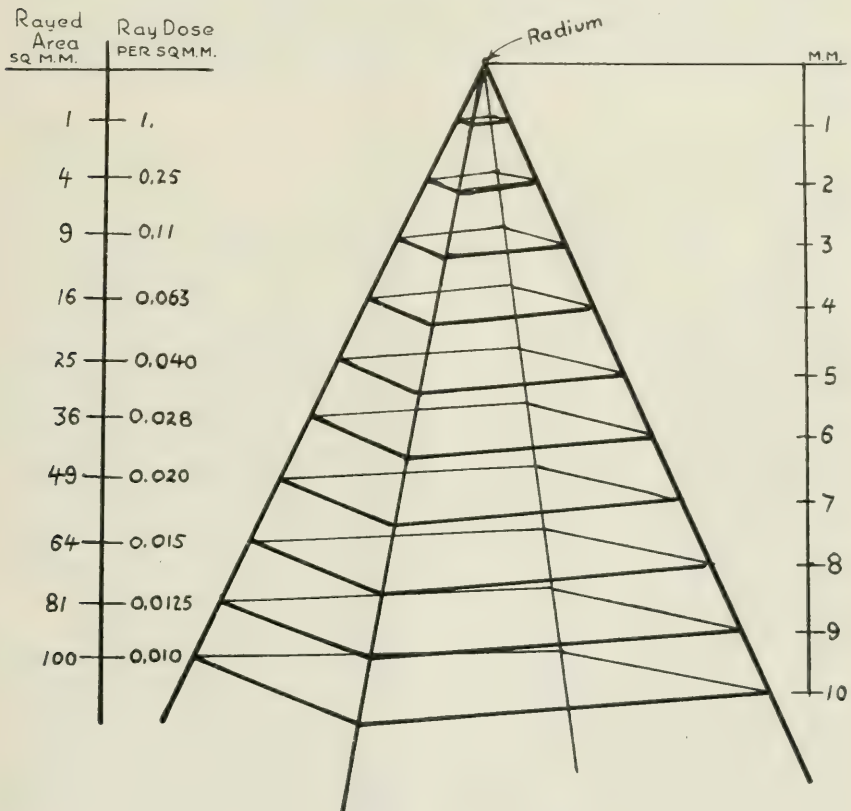


FIGURE II.

filtration. It is seen that the falling off in ray dose per sq. mm. is very rapid in the first few mm., the dose falling from 1.0 at one mm. to 0.04 at five mm. Consequently a layer of tissue four mm. thick, which had the radium one mm. distant, would receive at the surface nearest the radium twenty-five times the ray dose that (neglecting absorption) would be received by the tissue surface five mm. from the radium. Due to the absorption of rays (one cm. soft tissue absorbs about three per cent of the hard gamma rays), the ray dose received by the outlying tissue

## RADIUM

would be even somewhat less. The same four mm. layer of tissue, if placed so that the radium is six mm. distant, will receive on the near surface a ray dose of 0.028 and on the far surface a ray dose of 0.010 per sq. mm. This is a ratio of three to one, as compared with the ratio of twenty-five to one in the other case. It is obvious that the second arrangement would require a longer application of the radium to attain a given total dosage; however, the different layers of tissue would be receiving more nearly the same dose of rays, and this is the one of the most important points in the technic of radium therapy. To obtain as nearly as possible a homogeneous irradiation of the neoplasms should be the constant effort of the radium therapist. To effect this homogeneous raying the various devices, such as cross firing, use of radium spread over a considerable area as in the flat plaques, use of a number of tubes placed about on the growth (or a number of needles injected into the growth), and the use of the radium tubes at varying distances have been adopted. All these methods have their advantages and limitations.

The use of radium at considerable distances, such as several inches, is only possible in the treatment of superficial growths, since it is evident that if a deep seated growth were so treated, all the adjacent normal tissues would be receiving a very considerable dose of rays, the effect of which cannot be neglected. When this method is pushed to the extreme, as in the use of very large amounts of radium (several hundred milligrams up to a gram) the method does not seem safe, since it is not unlikely that by this method of application there will result a stimulating effect of the rays acting on outlying incipient metastatic growths. This the writer has seen quite well exemplified in an inoperable case of cancer of the breast, where several rayings at a distance of a few inches from the growth, using well upwards of a gram of radium element, resulted in a rapid development of metastases in the adjacent glandular tissues, including the other breast and in the liver. It is quite possible that a smaller quantity of radium applied at a less distance would have given the same improvement that was observed in the primary lesion, without the stimulating effect on the adjacent tissues.

Often the radium must be applied in such a limited space as to render it difficult to screen the tube properly. This is particularly true in treating malignant growths in the body of the uterus where dilatation is required. In such cases the tendency has been to dispense with as much of the screening as possible and risk the consequences. Where dilatation can be effected, it would seem to be preferable. In the treatment of the cervical cases, there is much less difficulty, since more space is available for placing the radium and packing gauze to hold the radium as far as possible from the healthy vaginal mucosa.

From what is known of the absorption of the beta rays and the effect of distance on the intensity of the gamma rays, it is the writer's belief that the tendency in the past has been to use too great thickness of metal screens, resulting in a waste of the gamma rays. Except for aluminium, one to two mm. of ordinarily used metals suffice to absorb practically all of the beta rays, and further screening may well be non-metallic. Where three mm. of lead and three to five mm. of rubber are used, it is evident that the distance factor introduced by these consid-



erable thicknesses becomes of importance. It is possible, therefore, that some good results and some indifferent results may be accounted for on the basis of variation of the distance at which the radium was applied, when it might seem, at first thought, that the more important difference had been in the thickness of screens used.

For a time lead was widely used as a screening metal, and then, because some observers found bad radium burns, lead was largely discarded, and now an equivalent thickness of brass or silver is commonly used. It is doubtful whether these seeming differences in the secondary ray effects of different metals are real. It is probable that in the present state of our knowledge of the technic of radium application the dosage applied to various growths is not nearly so accurately known as many seem to think, and it is rather more probable that we can ascribe many results to dosage variations which have come about because of seemingly comparatively insignificant changes in the distance at which the radium is applied and a failure to take into account the idiosyncrasies of various tissues in individuals of different ages and different past histories.

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## REVIEWS AND ABSTRACTS

Francis W. Peabody, M. D. (Boston). Report on the Treatment of Myelogenous Leukemia with Radium. Boston Med. and Surg. Jour., CLXXVII, Dec. 20, 1917, pp. 873-874. (From the Cancer Commission of Harvard University.)

"Since the opening of the Huntington Hospital five years ago, 36 cases of chronic myelogenous leukemia have come under observation. Nineteen of these have died, and at the present time 17 cases are being more or less actively followed. The physician in charge of the group of patients with leukemia meets them on one afternoon a week at the hospital. Patients are supposed to report weekly for general examination and blood examination, but those whose condition is satisfactory or who live at a distance may be excused from attendance at the clinic for two or three weeks at a time. Constant supervision is an important factor in the care of these patients, for it makes possible the institution of radium therapy when the earliest signs that it is indicated appear. Occasionally patients disappear for long periods, to return only when severe exacerbations of the disease have appeared. It is, of course, impossible to control all patients as carefully as would be desirable, but over half of the present group report with considerable regularity."

RESULTS OF RADIUM TREATMENT. "The results from the use of radium may be discussed from the point of view of its effect on the general symptomatic condition of the patient, on the splenic tumor, and on the blood picture."

*"Symptomatic Condition.* One of the most striking results of radium therapy in this series of patients with leukemia has been the general

clinical improvement. Without exception the cases treated during the last eighteen months (the duration of personal observation by the writer) have shown symptomatic improvement, and in some instances (15,274; 15,322; 16,161; 14,140, the change has been little short of remarkable. Patients who were at one time bed-ridden, extremely weak, pale, dyspneic and apparently in a very serious condition, have regained their strength and have subsequently returned to leading a comparatively normal life. Almost all of the patients who have been closely followed during the past year and a half are at work or performing their usual household duties. The appetite improves, the digestive disturbances gradually become less, and weight is usually gained. Headache is often relieved, and buzzing, roaring or "beating" in the ears, a common and disagreeable symptom, frequently diminish, and are sometimes completely cured. In one instance with complete deafness (16,406), the hearing was not improved even after many treatments with radium."

*The Spleen.* When first seen the patients have a large, often an enormous spleen, but under the influence of radium a rapid decrease in size takes place. In many cases the spleen diminishes so that its lower pole is above the costal margin, and in some instances it has become so small as not to be palpable. Occasionally it may be impossible to reduce the size of the spleen so satisfactorily and it remains enlarged so that the lower edge is well below the ribs. In one case (16,125) the spleen became greatly enlarged during a terminal exacerbation of the disease and continued so in spite of vigorous treatment until the patient's death. In general, the patients in whom radium therapy produces a decrease in the size of the spleen seem to be the most favorable cases for treatment. The shrinking of the spleen may be a rapid process and an organ which has filled nearly one-half of the abdominal cavity may disappear behind the ribs in the course of eight and one-half weeks and after thirteen treatments (16,346)."

*The Blood.* The most definite effect of the application of radium in myelogenous leukemia is on the blood picture. In cases which have received no previous similar treatment and which have a high leucocytosis the number of white cells usually begins to fall in from twenty-four to seventy-two hours after the radium is applied. The decrease in the leucocytosis is often rapid and continues for days and even several weeks after the radium was administered. In one patient the white count dropped from approximately 100,000 to 6,100 in twenty-five days, radium having been given on the first and thirteenth days only. Even more striking results have been observed in other instances. Associated with the decrease in the total leucocyte count there is a change in differential count. Myelocytes and immature forms of polymorphonuclear leucocytes become less prominent and a larger proportion of adult polymorphonuclear cells is found. Usually, however, careful searching will always reveal the presence of a limited number of typical myelocytes. Patients with an anemia, who respond well to treatment, show a rise in hemoglobin and in the red cell count associated with their improvement. On the other hand, the development of an anemia in a case under observation is to be regarded as a serious sign. A fall in hemoglobin and the occurrence of many nucleated red cells is of serious prognostic significance, but the picture may improve in response to radiation. An important point to bear in mind is that the development of anemia may be the result of too much radiation. It is almost certain that this took place in one



patient (16,406) who died with a low white count (2,000) and a hemoglobin of ten per cent. This case, which presented remarkable pathological lesions, will be reported in detail by Dr. Goodpasture."

"While it is comparatively easy in most cases to bring the leucocyte count down to normal, it is much more difficult to keep it there. A remission usually takes place after a few weeks, and more radium must be applied. The attempt has been made to treat patients soon after the white count began to rise, and by prompt application of radium it is possible to keep the count at from 5,000 to 40,000 or 50,000. Often the leucocyte count will remain within normal limits for weeks without any treatment. One patient (15,274) came into the hospital in January, 1916, with a bad clinical relapse and a white count of 248,000. His leucocytes were reduced to 6,000 on February 29, 1916, and remained below 17,400 without any treatment until November 23, 1916. In general there seems to be a close parallelism between leucocyte count and clinical condition. When patients report that they are feeling poorly the white count is frequently found to be high. This is not always true, however, and patients seem to do well clinically if their leucocyte count is not over 50,000. The white count, however, is the best routine guide to treatment, and the attempt is always made to keep it within normal limits. The intervals at which it has been necessary to administer radium have varied greatly from case to case in any given individual, but they have perhaps averaged one to three months."

"In one of our cases a few applications of radium were made over the long bones, but in all other instances treatment has been applied over the spleen in the French manner used in this hospital and recently described by Ordway in detail. (*Boston Med. and Surg. Jour.*, CLXXVI, 490, April 5, 1917.)\* Our experience does not as yet enable us to state definitely as to the best dosage, but recent results have seemed to indicate that the administration of one or several large treatments, followed by an intermission of at least several weeks, until all evidence of radium action has ceased, is more satisfactory than the use of smaller doses at more frequent intervals. This, however, is a point which requires further study. Extensive radiation over the spleen often produces nausea which persists for one to four or five days, and in some instances vomiting occurs. The danger of excessive radiation has already been referred to. This is best avoided by not instituting new treatment until the effects of the last treatment have completely subsided, and by watching carefully the hemoglobin and red count as well as the leucocyte count."

"When, under the influence of radiation, a large splenic tumor decreases in size rapidly it is to be expected that profound changes in the metabolism and in the excretion of waste substances in the urine will take place. The opportunity was therefore taken to study as thoroughly as possible the metabolism in one of our cases. The patient was in the wards of the Peter Bent Brigham Hospital and was kept on a carefully calculated constant diet for a period of nearly forty days. Frequent observations were made on the gaseous exchange, and on the various constituents of the blood, and daily analyses of the urine were carried out. The results of this study will form the basis of a separate communication."

"It is too soon for us to make any final statement as to the effect of radium therapy on myelogenous leukemia. In spite of the compara-

\* Reprinted in *Radium*, X, Oct. 1917.—Ed.

tively large number of cases which have attended the clinic, only a few can be regarded as having been thoroughly or satisfactorily treated, and the natural duration of the disease is so variable that it is quite impossible for one to know whether or not the length of life has been influenced. It is, on the other hand, quite certain that temporary remissions of the disease have been brought about, and that patients who were in a most distressing and apparently serious condition have been restored to a useful and functionally efficient existence."

\* \* \* \* \*

C. Jeff Miller, M. D., and E. L. King, M. D. (New Orleans). The Use of Radium in Non-Malignant Uterine Hemorrhage. Presented at the Eleventh Annual Meeting of the Southern Medical Association, held in Memphis, Tenn., Nov. 12-15, 1917. Abstracted from Medical Record, Dec. 15, 1917, Vol. 92, No. 24.

"The authors said that the non-malignant conditions of the uterus causing menorrhagia or metrorrhagia might be grouped as follows: (1) Cases in which there was little or no demonstrable pathologic change in the uterine wall, no history of infection, and in which the uterus was apparently normal in size and position, with normal adnexa. In such cases the bleeding was, in all probability, due to some disturbance of the internal secretions, especially of the thyroid or of the ovary. This condition was often encountered in young girls about puberty. (2) The menopause. (3) Chronic metritis. (4) Hypertrophy, or hyperplasia of the endometrium, especially when so marked as to be adenomatous or polypoid in character. (5) Fibroids, adenomata, or adenomyomata of the uterus. (6) Chronic endometritis, especially after incomplete abortion. (7) Passive congestion of the uterus, as in retroflexion or prolapse. In the first three groups radium might be used to the exclusion of surgery; in groups four and five, some cases were suitable for radium, and others required operation; while in groups six and seven, operation was indicated. They had treated ten cases classified under groups one and two. The youngest was in a girl of sixteen, who had bled profusely for months; the others were in patients from twenty-five to forty-six years of age. In all of them the bleeding persisted for years. They had all been curetted from one to six times without relief; most of them had also been treated medicinally in various ways; one had had twenty-three and one twenty-eight X-ray treatments. All were naturally anemic and debilitated, especially the sixteen-year-old girl, who was in bad shape. Nine of them were given intrauterine radium treatments, the average dose being about 1,000 milligram-hours. One patient was given a very short treatment, two and one-fourth hours' treatment, the radium being placed in the upper vagina. The periods became normal, and she was now in robust health. In only one patient did the treatment fail to relieve the condition. In two other cases it was necessary to repeat the treatment. Only one patient suffered from severe menopausal symptoms, although in several of them the symptoms were present in a mild degree. The next eighteen cases fell in the third and fourth groups. The patients ranged in age from thirty to fifty-five, and most of them had suffered from bleeding for several years—as a rule, menorrhagia first, and later metrorrhagia as well. In every case examination revealed a large, often



tender uterus, with no sign of tumor or adnexal trouble. Of these eighteen patients thirteen had been curetted from one to four times, and seven had had other operations on the uterus or adnexa performed at the same time, all without relief. One of these had also had subsequent X-ray treatments, with no improvement. The other five had been treated medicinally in various ways, including packing. In every case radium treatment was followed by amenorrhea; in two patients there was a recurrence of the bleeding about one year later, the flow being approximately normal. The others were still relieved. Six patients suffered from marked menopausal symptoms; five others were similarly affected, but the symptoms were mild and transient. The patients suffering most from the artificial menopause were nearly all between forty and fifty-one; this coincided with the author's experience after hysterectomy. In three women, aged thirty-five, forty-five and fifty-one, the condition was relieved by corpus luteum extract. Eight patients suffered from leucorrhea for two or three months after the treatment. In those cases in which subsequent pelvic examinations were made marked reduction in the size of the uterus was found, and the tenderness, as a rule, disappeared. The dosage in these cases was 500 to 1,000 milligram-hours. Their results had been and were most gratifying, and they believed there was a definite field for radium therapy in the treatment of these annoying and often obstinate affections. It was not a cure-all, but its judicious use would often obviate the necessity of a mutilating operation with the attendant risk to the patient, whose well being should be our constant aim."

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S. Recasens. Radiumtherapy in Cancer of the Uterus. Arch. mens. d'obst. et de gynec., 1917, vi, 34. Abstracted in Surgery, Gyn. & Obst., p. 260, Sept., 1917.

"Recasens divides his treated cases into three groups: (1) cases which may be considered operable; (2) inoperable or where even a very extensive exeresis would not guarantee the extirpation of the invaded area; (3) cases of recurrence after uterine extirpation. A fourth group is added comprising cancer of the uterine body located entirely above the isthmus.

"The statistics of each group are shown in the following table:

## GROUP 1—OPERABLE CANCERS.

Number of cases treated .....	16
Number of recoveries .....	16

## GROUP 2—INOPERABLE CANCERS.

(a) Cases treated for more than two years .....	47
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### Dead

in 1914 .....	7
in 1915 .....	8
in 1916 .....	3
Metastasic reproduction .....	2
Clinical recoveries .....	27
(b) Cases treated for more than one year .....	79
Treated with radium alone .....	45
Treated with radium and X-rays .....	34

Dead	
1915	18
1916	11
Metastatic reproductions	5
Clinical recoveries	45
(c) Cases treated less than one year	76
Dead	14
Clinical recoveries	32
In course of treatment	30
GROUP 3—PATIENTS TREATED AFTER HYSTERECTOMY.	
(a) After vaginal hysterectomy	3
Dead	1
Clinically recovered	2
(b) After abdominal hysterectomy	2
Dead	1
Metastatic reproduction	1
GROUP 4—CARCINOMA OF UTERINE BODY.	
Number of cases treated	16
Dead	6
Clinical recoveries	8
In course of treatment	2

## COMPLICATIONS MET WITH IN THE COURSE OF TREATMENT.

Rectovaginal fistulæ	5
Vesicovaginal fistulæ	3
Vesico-uterine fistulæ	1
Late hæmorrhages	2
Renal metastases	5
Metastases in other organs	1
Compression of the iliac veins	1
Intestinal occlusion	1

"In none of the cases did the author observe any ureteral lesions due to the radiation."

"The most important point the author gleaned from his observations was that seventy per cent of inoperable carcinomata of the neck of the uterus may be cured by the use of radium and X-rays employed together, and that for selected cases the percentage of recoveries rises to ninety-five per cent. As regards carcinoma of the corpus, in thin women operation is preferable, but in obese women in spite of the inconveniences of treatment there is recovery in fifty per cent of the cases."

"Without admitting that this new method of treatment is a definite solution of the treatment of uterine cancer in the author's opinion its success has not been surpassed by any other methods, even by the most radical surgery."



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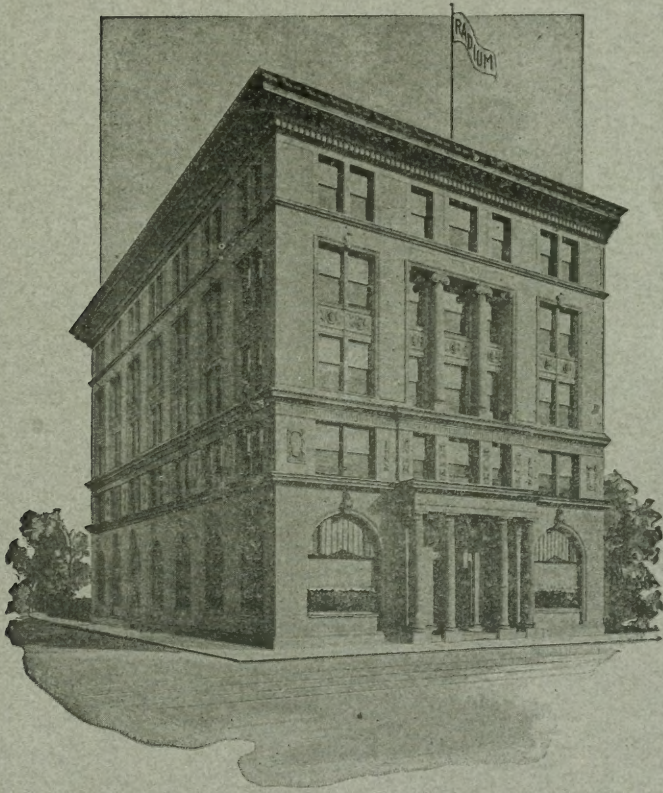
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